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Зборник радова
XVI Конгреса геолога Србије

Proceedings
of the XVI Serbian Geological Congress

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ОПТИМАЛНО ИСТРАЖИВАЊЕ И ОДРЖИВО КОРИШЋЕЊЕ ГЕОЛОШКИХ РЕСУРСА

OPTIMAL RESEARCH AND SUSTAINABLE USAGE OF THE GEOLOGICAL RESOURCES

Donji Milanovac, 22-25.05.2014.

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САДРЖАЈ / CONTENT

QUALITATIVE QUANTITATIVE FEATURES OF CLAY FROM THE SITE BAZERNIK (WESTERN MACEDONIA)

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Key words: deposit, Bazernik, clay , schist , qvarcporfire , qualitative and quantitative characteristics, mineralogical compound, chemical compound.

Abstract: Clay schist and clay from the vicinity of Bazernik - Demir Hisar in the future may represent an important economic entity in the production of clays in Macedonia, requires monitoring of economic parameters in function of current trends in assessment of the justification of the use of clay and clay schist and the possibility of valuation and associated components too.
Following the release mode , multi-layered system of cracks and cracks degree of compactness and purity fragmented clay enabled the determination of the qualitative and quantitative characteristics of the clay.
The clay schist and the clay from the deposit Bazernik, based on their qualitative characteristics, can be found in their natural state, and might be applied in the production of acid-resistant ceramic products with great quality.
They can be found in their enriched state, so they might be applied in the paper industry, cosmetic industry etc.

INTRODUCTION

The site Bazernik is located near the village Bazernik, an area that territorially is a part of the municipality of Demir Hisar. It is located at a distance of 50km from Bitola and 10 km from the railway station Sopotnica (Fig. 1). The site Bazernik is explored with excavation on the surface, and within the scope of 1020 using pit exploration. Regarding this exploration it is determined that the site is comprised of white clay, clay shist, as well as green metamorphic quartz porphyry. The clay and the clay shist represent a mineral mass and the metamorphic quartz porphyry is a slag.

Figure 1. Map of the R. Macedonia with position the Bazernik lokality

The clays and the clayed schist from the surroundings of Bazernik – Demir Hisar may represent an important economical subject for the clay production in Macedonia in the future. The monitoring of the economical parameters for the contemporary trends allows to evaluate the

justification of the clays and clay schist usage and the possibility to evaluate their accompanied components.
Within the hitherto explorations, there is a particular attention on the radio – structural explorations, which have determined the existence of the main mineral stages during the creation of the clay and clay schist layers.
The site Bazernik has been discovered in 1969 when the basic geological data has been collected (Zatkovski, 1969). In 1970 a program for detailed exploration of the site has been developed, and within the same year a detailed explorations regarding tachometric recording, geological mapping of the site, chemical examinations, diggings, technological examinations, chemical analysis, radio and petrographic examinations have been conducted (Zatkovski, 1971). A mine geodesic recording, mapping of the mine exploration, undermining and excavations have also been conducted. The newest data about the qualitative and quantitative characteristics of the site Bazernik can be found in Jovanov's papers (2010)

GEOLOGICAL CHARACTERISTICS

The geological composition of the mineral body is determined based on the geological mapping and the surface and pit explorations.
The mineral body "Bazernik" has a shape of an elongated body comprised of white clay, dark – green metamorphic quartz porphyry, clay schist and white rough metamorphic quartz porphyry. Given that the diameters do not intersect the mineral body, it wasn't possible to establish if the top part is comprised solely of metamorphic quartz porphyry, as it was predicted on the transversal geological profiles.
The clay and the clay schist represent a mineral matter, whereas the white and the dark – green metamorphic quartz porphyry represent non – mineral matter (Fig. 2).
The clay (Fig. 3), seen macroscopically, has white color and plastic properties and it's comprised of rough and fine - granulated fractions. The first fraction is represented with 44 – 66 % with grains bigger than 0.06mm, and the second fraction with microscopical grains. Using radioscopic thermodiferential examinations it is determined that the mineral mass consists of kaolin and illit. There are quartz grains and fragments of a sound rock mass in the clay matter. It's found on the base part of the mineral body and it's shaped like an irregular wire 3-8 meters thick. It declines astride northeast under variable declining angle from 15 to 65 degrees. It is also found with the same structure within the native rock, having well preserved elements of schist with clearly expressed forms of the clay feldspars.
The clay schist (Fig. 4), macroscopically speaking, has greenish white colour and rather small firmness and hardness. When pressed insignificantly with the fingers it decomposes in a fine decomposition comprised of leaf – like fragments and clay matter. It's comprised of white clay and schist matter that consist of basic matter built from Si matter, sericite, chlorite, epidote, zoisit, a little allanite, in which there are Phenoklasts and rarely K – feldspars. It declines astride northeast under variable declining angle.
The dark – green metamorphic quartz porphyry is situated in the central part of the mineral body, between the white clay and the clay schist. It has a remarkable firmness and hardness. It is comprised of a basic, significantly siliphied matter with sericite and fine – dispersed opaque matter. Within the basic matter there are phenoplasts comprised of quartz and certain amounts of K – feldspare.

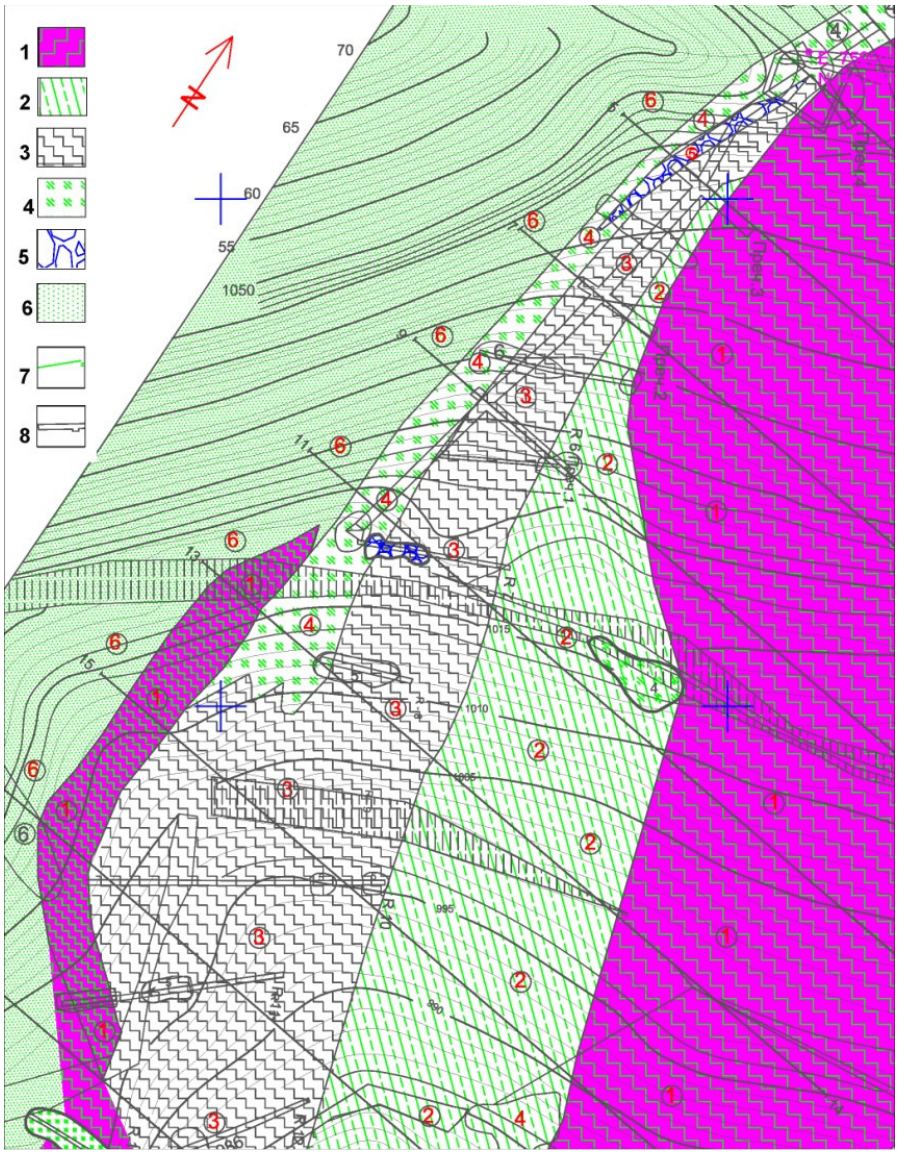

Figure 2. Geological map of the Bazernik area
1.purple and other schist, 2. white rough metamorphic quartz porphyry, 3. clay schist , 4. white clay, 5. dark – green metamorphic quartz porphyry, 6. gray crystalline limestone, 7. route the cross section, 8. tag to undermine and shaft.

The whitish quartz porphyry macroscopically has a greenish white colour. The schist surfaces are streaked with manganic dendrites. Under compression it decomposes in parallelopipedic decomposition. It's mineralogically comprised of partially syliphied and carbonized basic matter weaved with fine dispersed opaque matter, where quartz aggregates and sericit relics can be seen. The phenoclasts are comprised of quartz and partially carbonized schist that declines astride northeast under viable declining angle.

Figure 3. White clay at the deposit of Bazernik

Figure 4. Clay schist at the deposit of Bazernik

QUALITATIVE CHARACTERISTICS

In order to distinguish the qualitative characteristics of the clay and the clay schist from the site Bazernik, representative samples are used for distinguishing the main components.

In the Table 1 are shown the given results from the completed chemical explorations of the clay. From the given chart we can see that the clay consist of high contents of SiO_2 with medium composition of 71.46 %, followed by Al_2O_3 with medium composition of 12.12 %, and the Fe, Fe_2O_3, CaO, K_2O are least included. In the Table 2 are shown the given results from the completed chemical exploration on the clay schist. According to the chart the SiO_2 and Al_2O_3, like in the clay, are the most included, and the Fe, Fe_2O_3, CaO, K_2O are less included. According to the charts we can conclude that the clay and the clay schist have almost equable chemical composition.

Table 1. Chemical composition of the clay (%)

Compo-nents	Number of sample											Average composition
	1'	2'	3'	4'	9'	12'	11'	14'	17'	21'	n	
G z	3.86	4,46	4,32	3,86	4,63	3,71	5,97	7,01	4,75	4,83	10	4.65
SiO_2	74.91	72,37	72,12	71,82	70,99	73,97	70,04	68,36	69,46	70,56	10	71.46
Fe_2O_3	1.50	1,80	1,90	2,10	2,80	2,00	3,80	3,00	2,60	3,29	10	2.47
Fe	1.04	1,25	1,32	1,45	1,94	1,39	2,54	2,09	1,80	2,25	10	1.70
FeO	1.20	1,36	1,30	1,52	1,68	1,10	0,58	0,20	2,05	0,40	10	1.14
Al_2O_3	11.99	12,42	13,18	12,86	12,35	12,16	11,96	9,88	12,01	12,44	10	12.12
TiO_2	0.14	0,18	0,20	0,14	0,20	0,20	0,18	0,12	0,17	0,14	10	0.16
CaO	3.12	3,90	3,86	3,44	2,86	2,86	3,14	5,72	3,12	4,05	10	3.61
MqO	1.33	1,52	1,42	1,53	1,47	1,50	1,68	,66	2,28	1,68	10	1.71
CO_2	0.20	0,18	0,30	0,20	0,32	0,20	0,36	5,04	0,75	0,41	10	0.80
Na_2O	1.20	1,30	1,30	2,30	1,30	1,00	2,30	1,30	1,65	0,95	10	1.46
K_2O	1.95	2,05	1,75	1,95	2,40	2,60	1,85	1,95	1,95	2,10	10	2.05

Table 2. Chemical composition of the clay schist (%)

Compo-nents	Number of sample													Average composition
	6'	7'	8'	10'	13'	15'	18'	19'	20'	22'	23'	24'	n	
G z	2.84	4.38	3.16	2.66	4.12	4.11	3.44	4.62	4.38	3.76	4.24	4.30	12	3.84
SiO_2	72.45	71.90	72.31	73.28	71.78	71.54	72.83	70.97	72.55	71.40	71.93	72.44	12	72.12
Fe_2O_3	2.00	1.60	2.20	4.60	3.24	3.40	20.70	3.40	2.20	2.14	1.60	2.20	12	2.61
Fe	1.39	1.50	1.50	3.20	2.25	2.36	1.86	2.36	1.94	1.46	1.10	1.53	12	1.94
FeO	0.96	1.20	1.36	0.45	0.31	0.30	1.44	1.30	0.90	1.08	0.92	1.32	12	0.96
Al_2O_3	12.87	12.99	12.87	9.36	11.42	11.40	12.22	12.18	11.96	12.38	11.64	12.56	12	12.04
TiO_2	0.18	0.12	0.19	0.14	0.16	0.22	0.21	0.14	0.17	0.21	0.18	0.14	12	0.17
CaO	3.38	3.90	3.51	3.69	3.82	3.44	3.24	3.43	3.28	3.76	3.16	3.35	12	3.49
MqO	1.33	1,90	1.61	1.52	1.86	2.14	1.96	1.86	1.94	2.10	1.75	1.68	12	1.81
CO_2	6.40	0.38	0.35	0.42	0.38	0.20	0.25	0.20	0.35	0.34	0.38	0.40	12	0.34
Na_2O	3.20	0.70	2.30	2.30	1.65	1.65	1.30	1.30	0.95	2.30	1.20	1.55	12	1.80
K_2O	1.75	2.45	1.85	2.10	1.95	2.10	2.10	2.10	1.95	1.95	1.30	1.95	12	1.96

QUANTITATIVE CHARACTERISTICS

Four mineral masses are distinguished with the determination of the clay's and clay schist's quantitative characteristics, which have been explored on a different level.

According to the level of exploration the mineral mass 2 is categorized within the reserves of the A category, the mineral masses 1 and 3 belonged to the B category, while the mineral mass 4 in the C_1 and C_2 category (Fig. 5).

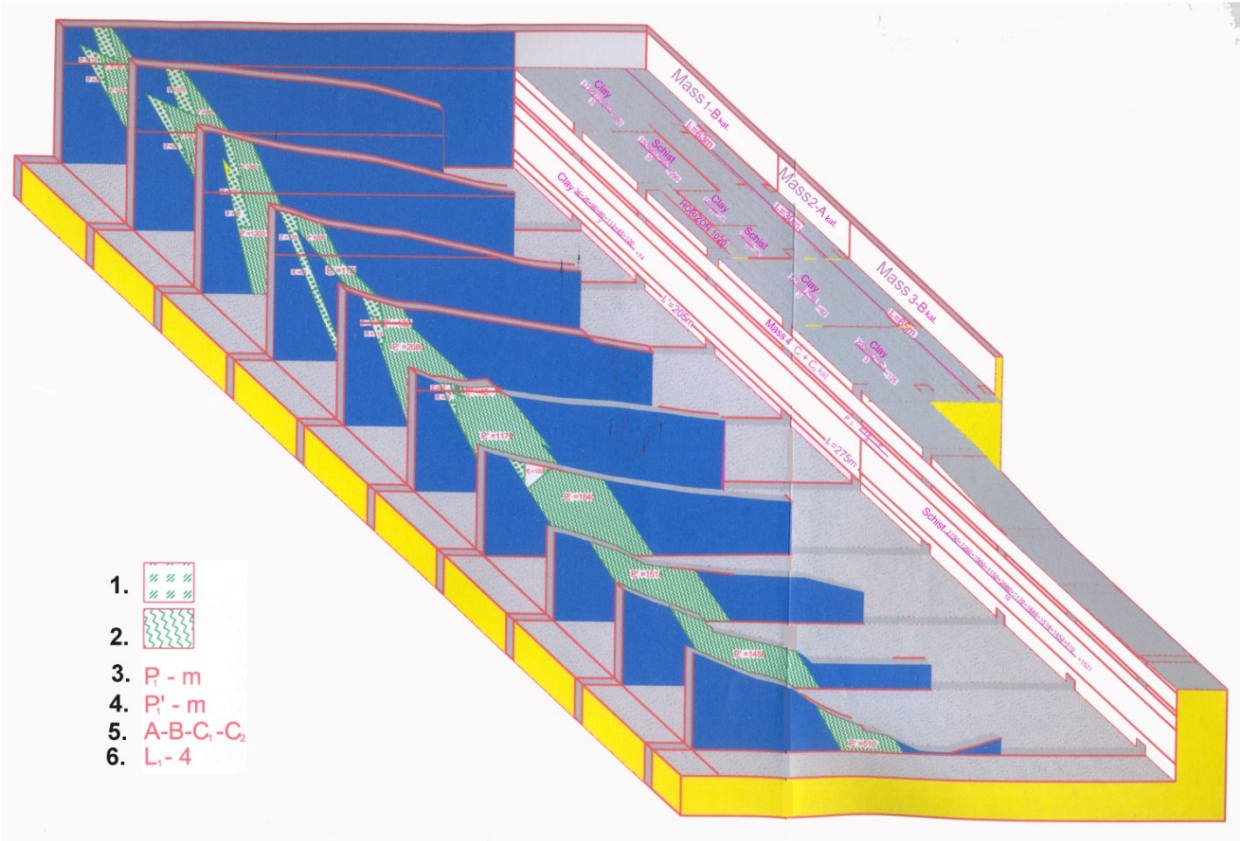

Figure 5. Schematic block diagarm the deposit Bazernik
1.clay, 2. clay schist, 3. surface of clay (m^2), 4. surface of schist (m^2), 5. tag category. 6. length (m).

According to the estimation of the mineral reserves, using the Profile method (Jankovic, 1957), (Blecic and Milovanovic, 1999) 7200 tons of the A category and 35. 774 tons of B category are estimated to be clay reserves.

Within these estimations 16,800 tons of clay schist reserves belong to the A category, 52,790 tons to the B category and 836,550 tons to the C_1 category.

73,610 tons of clay reserves and 910,140 tons of clay schist of A, B, C_1 and C_2 category are determined.

CONCLUSION

According to the afore mentioned in the graduate thesis we can conclude the following:

The site Bazernik is located at a distance of 50 km from Bitola and 10 km from the railway station Sopotnica. The wider surrounding of the site Bazernik is comprised from Paleozoic and Triassic rocks represented with different schists, partially crystal dark-grey lime stones and metamorphic quartz porphyry, purple schists, double – basis series and strong sediment of crystal

multi colored limestone. The site Bazernik is explored with excavation on the surface, and within the scope of 1020 using pit exploration. Regarding this exploration it is determined that the site is comprised of white clay, clay schist, as well as green metamorphic quartz porphyry. The clay and the clay schist represent mineral matter and the metamorphic quartz porphyry is a slag. Within the composition of the mineral body four masses are distinguished divided into A, B, C_1 and C_2 category. There are 73,610 tons of clay reserves, out of which 7200 tons belong to A, 35, 774ons belong to B and 30, 636 tons to C_1 and C_2 category. There are 908, 140 tons reserves of clay schist, out of which 16,800 tons belong to A category, 52, 790 belong to B category and 836, 550 are from C_1 and C_2 category. Using detailed explorations it is determined that the clay and the clay schist can be used as acidulous resistant products in their natural condition. When supplemented they can be used in the food industry, the paper industry, the cosmetics industry and the paints and varnishes industry.

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